Rurality, deprivation, and excess winter mortality: an ecological study

D A Lawlor, R Maxwell, B W Wheeler

METHODS AND RESULTS

The reasons for the higher levels of excess winter mortality in Britain, compared with countries with colder winters, are unclear. Ecological studies suggest that both increased outdoor and indoor cold exposure relating to poor housing energy efficiency and lack of adequate clothing and physical activity when outdoors are important.\(^1\)\(^2\) It seems plausible that excess winter mortality would be greater in more deprived areas as deprived populations are more likely to live in poor quality energy inefficient housing and are less likely to be car owners. Two British studies have found no association between area deprivation and excess winter mortality, but both were based in single district health authorities and may not have had the power to detect an association.\(^3\)\(^4\) Furthermore, both studies were based in urban areas and were unable to assess the association between excess winter mortality and rurality.

It has been suggested that rural areas in Britain are at increased risk of excess winter mortality and that government action should be targeted at these areas. A range of features—poor quality housing, high proportion of detached houses, lack of access to gas networks, and low take up of government energy efficiency grants—may make rural populations vulnerable to indoor cold exposure. Outdoor occupations and poor public transport systems in rural areas may increase outdoor cold exposure.

The aim of this study was to assess the association between both rurality, and area deprivation, and excess winter mortality in a large region of England with a population of nearly six million and a distribution of both urban and rural areas.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Trends in seasonality ratio across quintiles of population density and Townsend score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population density (rural)</td>
<td>Quintiles of ward population density (range of population/km(^2))</td>
</tr>
<tr>
<td>Number of wards</td>
<td>234</td>
</tr>
<tr>
<td>Seasonality ratio (95% confidence intervals)*</td>
<td>116.32 (112.42 to 120.36)</td>
</tr>
<tr>
<td>Area deprivation</td>
<td>Quintiles of Townsend deprivation score (range of Townsend score)†</td>
</tr>
<tr>
<td>Number of wards</td>
<td>234</td>
</tr>
<tr>
<td>Seasonality ratio (95% confidence intervals)*</td>
<td>115.28 (112.48 to 118.15)</td>
</tr>
</tbody>
</table>

*Seasonality ratio: mean age sex directly standardised mortality rate in the winter months (December to March) divided by mean age sex directly standardised mortality rate in the non-winter months, expressed as a percentage. Data aggregated over five years 1994–98; †higher scores (highest quintiles) indicate greater deprivation.
the correlation between log population density and seasonality ratio was $-0.01$ ($-0.07$ to $0.05$) $p=0.7$ and that between Townsend score and seasonality ratio was $-0.04$ ($-0.10$ to $0.02$) $p=0.2$. As population density may be associated with deprivation we assessed the independent association of each using partial correlation coefficients. The partial correlation coefficients adjusting simultaneously for log population density and Townsend score were the same as the unadjusted coefficients: partial correlation coefficient between log population density and Townsend score controlling for Townsend score $0.01$ ($-0.05$ to $0.07$) $p=0.7$ and for Townsend score controlling for log population density $-0.04$ ($-0.10$ to $0.02$) $p=0.2$.

When seasonality ratios were calculated for the age group 0 to 64 years only there remained little association between Townsend score and seasonality ratio $-0.06$ ($-0.12$ to $0.00$) $p=0.06$.

**COMMENT**

This study confirms, in a larger population, the findings of two previous studies that excess winter mortality is not associated with area deprivation. We have also found that excess winter mortality is not associated with rurality. Although people living in deprived and rural areas are likely to have greater difficulties keeping their houses warm during the winter months they may protect themselves from the extreme effects of cold by wearing extra clothing, living predominantly in one or two heated rooms, and keeping physically active. Alternatively the overall increase in ill health and total mortality associated with deprivation may mask any seasonal variation in deprived groups.

In this study and in previous studies Townsend scores have been used as a measure of deprivation in the assessment of the association between area deprivation and excess winter mortality. The Townsend score is based on car ownership, unemployment, overcrowding, and housing tenure and the strength of association between this score and health outcomes attenuates with increasing age. As most excess winter mortality occurs in older age the Townsend score may be a poor indicator of deprivation in the association with excess winter mortality. When the analysis was restricted to younger age groups there was a weak association with Townsend score. Conclusions from ecological studies are limited by the effect of the ecological fallacy and we have not adjusted for the influence of different numbers of residential homes or differences in temperature between wards. Mean winter temperatures are unlikely to have differed greatly between the wards in the South West region. In a previous study the lack of an association between Townsend scores and excess winter mortality remained unchanged when deaths occurring in nursing or residential homes were removed from the analyses.$^5$

There is no agreed definition of rurality and different measures—the Office for National Statistics Ward Classification, distance to nearest neighbour and population density—have all been used to assess rurality in health services research, and been found to be associated with different health outcomes.$^7$ We chose to use population density as this is most likely to reflect the possible mechanisms—detached housing, lack of access to gas networks, and poor access to public transport—that have been proposed as reasons why there may be an increased risk of excess winter mortality in rural areas.

We conclude that neither rurality nor area deprivation are importantly associated with excess winter mortality. These results cannot be used to suggest that policy aimed at reducing fuel poverty and improving housing energy efficiency might not be appropriately targeted at more deprived groups and rural populations. Excess winter mortality is just one (extreme) health consequence that may be related to fuel poverty and action to combat any kind of poverty should not be undertaken purely on the grounds of health consequences.

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